WHAT IS CLAIMED IS:

1.   A storage system comprising:

    a first computer system configured to receive storage access requests from one or more user systems and to process the storage access requests;

    a first data storage system operative with the first computer system to satisfy received storage requests, the first data storage system comprising a plurality of data volumes including a primary volume and a primary difference volume;

    a second computer system;

    a second data storage system operative with the second computer system and comprising a plurality of data volumes including a secondary volume and a secondary difference volume;

    a first communication path between the first and second computer systems; and

    a second communication path between the first data storage system and the second data storage system,

    the first data storage system configured to perform steps of storing data received from the first computer system to the primary volume and communicating blocks of data from the primary volume to the second data storage system, and in response to receiving a first command from the first computer system:

        selectively storing subsequent data received from the first computer system to the primary difference volume;

        communicating blocks of data from the primary volume to the second data storage system; and

        upon completing the step of communicating blocks of data, communicating a first signal to the second data storage system,

    the second computer system configured to receive a second command from the first computer system and in response to take over receiving and processing of storage access requests whereby the first computer system ceases to process storage access requests,

    the second data storage system configured to selectively access first data stored on the first data storage system in order to service a storage access request received by the second computer system and further configured to store the first data in the second data storage system.

1   2.   The storage system of claim 1 wherein the step of selectively storing

2   includes storing the subsequent data on the primary difference volume if a block on the

3   primary volume to which the subsequent data would be written contains data that had not yet

4   been communicated to the second data storage system at a time when the first command was

5   received, and storing the subsequent data on the primary volume if the block on the primary

6   volume had already been communicated to the second data storage system at the time when

7   the first command was received.

1   3.   The storage system of claim 1 wherein the second data storage system

2   is further configured to perform steps of storing data received from the first data storage

3   system to the secondary difference volume, and in response to receiving the first signal,

4   copying data contained in the secondary difference volume to the secondary volume.

1   4.   The storage system of claim 1 further comprising a primary bit map

2   stored in the first data storage system, wherein the steps of communicating blocks of data

3   from the primary volume to the second data storage system is performed based on the

4   primary bit map.

1   5.   The storage system of claim 4 wherein blocks of data that are

2   communicated to the second data storage system after receiving the first command are those

3   blocks of data that had not yet been communicated to the second data storage system prior to

4   receiving the first command.

1   6.   The storage system of claim 1 wherein the first data is data that had not

2   yet been communicated from the first data storage system to the second data storage system

3   at the time the second computer system received the second command.

1   7.   The storage system of claim 1 wherein the second data storage system

2   includes an additional secondary difference volume and in further response to receiving the

3   first signal, storing data that is received from the first data storage system to the additional

4   secondary difference volume.

1   8.   A data storage method comprising:

2   (a) operating in a first mode, including:

3   i) receiving and processing storage access requests from one or more

4   user systems;

5   ii) if one of the storage access requests is a write request of data, then

6   storing the data on a primary volume of a first data storage system;

7   iii) if one of the storage access requests is a read request, then

8   accessing the primary volume to service the read request;

9   iv) communicating data stored on the primary volume to a second data

10   storage system; and

11   v) storing data received from the first data storage system to a

12   secondary difference volume of the second data storage system;

13   (b) operating in a second mode in response to the first data storage system

14   receiving a first command, the first command being received at a time T, including:

15   i) selectively storing subsequent data, received after time T, to a

16   primary difference volume of the first data storage system;

17   ii) communicating certain data on the primary volume to a second data

18   storage system, the certain data being data that had not yet been communicated to the

19   second data storage system at time T;

20   iii) storing data received from the first data storage system to the

21   secondary difference volume; and

22   iv) when all of the certain data has been communicated to the second

23   data storage system then copying data from the primary difference volume to the

24   primary volume and copying data from the secondary difference volume to a

25   secondary volume of the second data storage system; and

26   (c) operating in a third mode, including:

27   i) receiving and processing storage access requests from the one or

28   more user systems;

29   ii) if one of the storage access requests is a write request of data, then

30   storing the data to the secondary volume; and

31   iii) if one of the storage access requests is a read request, then

32   selectively accessing the primary volume to service the read request, and if data is

33   read from the primary volume then copying it to the second data storage system.

36

1   9.   The method of claim 8 wherein the step of selectively storing includes

2   storing the subsequent data to the primary difference volume if data in a data block of the

3   primary volume to which the subsequent data is to be written had not yet been communicated

4   to the second data storage system at time T, and storing the subsequent data to the primary

5   volume if data in the data block of the primary volume had already been communicated to the

6   second data storage system at time T.

1   10.   The method of claim 8 wherein in the step of operating in a first mode,

2   the steps of receiving and processing are performed by a first host computer, wherein in the

3   step of operating in a third mode, the steps of receiving and processing are performed by a

4   second host computer.

1   11.   The method of claim 8 wherein in the step of operating in a second

2   mode, the certain data is identified by a primary bitmap which indicates which data has been

3   communicated to the second data storage device and which data has not been communicated

4   to the second data storage device.

1   12.   The method of claim 8 wherein in the step of operating in a third

2   mode, the step of selectively accessing the primary volume is based on a bitmap which

3   indicates which data has already been copied from the primary volume and which data has

4   not been copied from the primary volume.

1   13.   A data storage system comprising:

2   first host means for receiving and processing storage access requests;

3   first storage means, in communication with the first host means, for storing

4 data;

5   second host means for receiving and processing storage access requests,

6 wherein only one of the first and second host means is active at any one time to process

7 storage access requests;

8   second storage means, in communication with the second host means, for

9 storing data;

10   first communication means for communication between the first host means

11 and the second host means,

12   second communication means between the first storage means and the second

13 storage means,

14   the first storage means comprising first controller means for writing data to a

15 first volume in the first storage means and for communicating stored data from the first

16 volume to the second storage means, the stored data being stored on a second volume in the

17 second storage means,

18   the first controller further for writing data to a first differential volume in the

19 first storage means instead of to the first volume in response to receiving a first command

20 from the first host means,

21   the first controller further for communicating certain data from the first

22 volume to the second storage means in response to receiving the first command, the certain

23 data being data that had not yet been communicated to the second storage means at the time

24 of receiving the first command, the certain data being stored on the second volume,

25   the second host means further for taking over the receiving and processing of

26 storage access requests in response to receiving a second command from the first host means,

27 wherein the first host means ceases to process storage access requests,

28   the second storage means comprising a second controller means, responsive to

29 the second command, for selectively accessing the first volume to retrieve data therefrom in

30 order to service a read request and for storing that data in the second volume.